

E. ALISON KAY

Missionary Contributions to Hawaiian Natural History: What Darwin Didn't Know

It is with great pleasure that we add our warm commendation of the late effort of the missionaries. Situated in a remote island, in the vast expanse of the Pacific intensely and ardently occupied in their great object, the moral improvement and civilization of the natives; remote from the lights of science, and subjected to the physical privations both frequent and severe, we certainly owe them many thanks for the great amount of valuable information which they have, incidentally, contributed, on the subject of the natural history of one of the most remarkable volcanic regions in the world.

Benjamin Silliman (1826)

THE ROLE OF THE AMERICAN MISSIONARIES and their descendants in the history of the Hawaiian Islands has been told in many different ways: in their own journals, letters, and autobiographies and in biographies and analyses of their educational motives, churchly objectives, and family life. One role has received virtually no attention, their contributions to knowledge of Hawaiian natural history. Charles Darwin's comment to Joseph Dalton Hooker in 1850, "of all places in the world I would like to see a good flora of the Sandwich islands. I would subscribe 50 pounds to any collector to go there and work at these islands,"¹ suggests that even Darwin, who had read everything there was to read about the Pacific,² failed to recognize that the missionaries, who had arrived in Hawai'i a decade before

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Darwin's own voyage to the Pacific, might be a source of information on the natural history of the Islands.

Darwin's challenge was unnecessary. The missionaries not only Christianized and educated but were themselves collectors in the Darwinian sense: volcano watchers, geologists, botanists, zoologists, geographers, climatologists, and mapmakers. Thirty of the pioneer missionaries recorded their observations of nature under some 94 published titles; another 170 titles were penned by 24 members of the second generation. These publications are found in nineteenth- and early twentieth-century scientific journals such as *The American Journal of Science*, *Edinburgh New Philosophical Journal*, *Nature*, and *Science*, as well as national and local media, *The Friend*, *Hawaiian Gazette*, *The Hawaiian Spectator*, *Maile Quarterly*, *Royal Hawaiian Agricultural Society Transactions*, *The Missionary Herald*, and *Scribners*. Articles published locally gained national and international attention when they were excerpted in newspapers and journals from San Francisco to Edinburgh.

This study summarizes the contributions of the first and second generations of missionaries sponsored by the American Board of Commissioners of Foreign Missions and examines the background and significance of their work.³ Except in two or three instances, published sources only are utilized; consideration of holograph letters and journals will undoubtedly add more to the story.

THE BIBLIOGRAPHIC RECORD

The volcano, in Joseph Goodrich's words, was "by far the greatest curiosity in the Islands,"⁴ and records of earthquakes, eruptions, fire fountains, and the like are the most numerous of the missionary publications. Of seven hundred annotated bibliographic records from the period 1826–1916 on the volcano,⁵ 25 percent are those of the pioneer missionaries and their immediate descendants. The authors' names read like roll call at the annual meetings of the Mission Children's Society: Alexander, Bailey, Baldwin, Bond, Bingham, Bishop, Coan, Ellis, Emerson, Forbes, Goodrich, Judd, Lyman, and so on. Ninety-one of the contributions are by first-generation missionaries, and seventy-seven are by their sons. Twenty-two of the missionary

fathers wrote of their excursions to Kilauea, Mauna Kea, and Mauna Loa, describing landscapes of lava, bubbling craters, bottomless crevices, fire fountains, and, incidentally, retrieving molten lava in a frying pan.⁶ The Rev. William Ellis of the London Missionary Society and three members of the pioneer mission company, Asa Thurston, Artemis Bishop, and Goodrich in 1823 were the first Westerners to record a visit to Kilauea.⁷ In 1823, Goodrich also ascended Mauna Kea. He apparently left other members of the mission party on the lower slopes of the mountain and reached the summit on his own, the first Westerner to have achieved that goal.⁸

One of the missionary fathers outdid all the others as volcano reporter: The Rev. Titus Coan, "who observed nearly every eruption of Mauna Loa and Kilauea between 1835 and 1882," was author of more than one-third of the 168 citations on volcanoes.⁹ Coan was familiarly known as "the bishop of Kilauea," and it was said that he "cared for it as he did for all his parishioners."¹⁰ His first wife, Fidelia, and his second wife, Lydia, each wrote a piece about the volcano, as did his two sons, Titus M. and Samuel L.¹¹ Fidelia Coan's 1852 letter in the *American Journal of Science* establishes her as among the first American women to have published in a scientific journal.

Sarah Joiner Lyman's Earthquake Diary, 1833-1917,¹² a journal recording earthquakes felt in Hilo and volcanic eruptions on Hawai'i, has attracted attention worldwide as an informative record on the frequency and strength of tremors and of volcanic activity; she was also author of a letter in the *American Journal of Science*. Mrs. Lyman kept her journal between 1833 and her death in 1885; it was subsequently maintained by other members of the Lyman family up to 1917. The journal was copied in part during Mrs. Lyman's lifetime by a French consul and by members of the U.S. Exploring Expedition.

In the period 1826-1916, there are also eighty-one titles on botany, land snails, birds, climate, and geology, eleven by the missionary fathers, seventy by their sons.¹³ Of the first-generation missionaries who wrote on these aspects of Hawai'i's natural history, Dr. Gerrit Judd and Dr. Dwight Baldwin reviewed descriptions of fossil coral reefs in Hawai'i and elsewhere in the Pacific respectively;¹⁴ the Rev. Hiram Bingham commented on a meteor shower;¹⁵ the Rev. Edward Bailey and Dr. Charles Wetmore compiled the first lists of

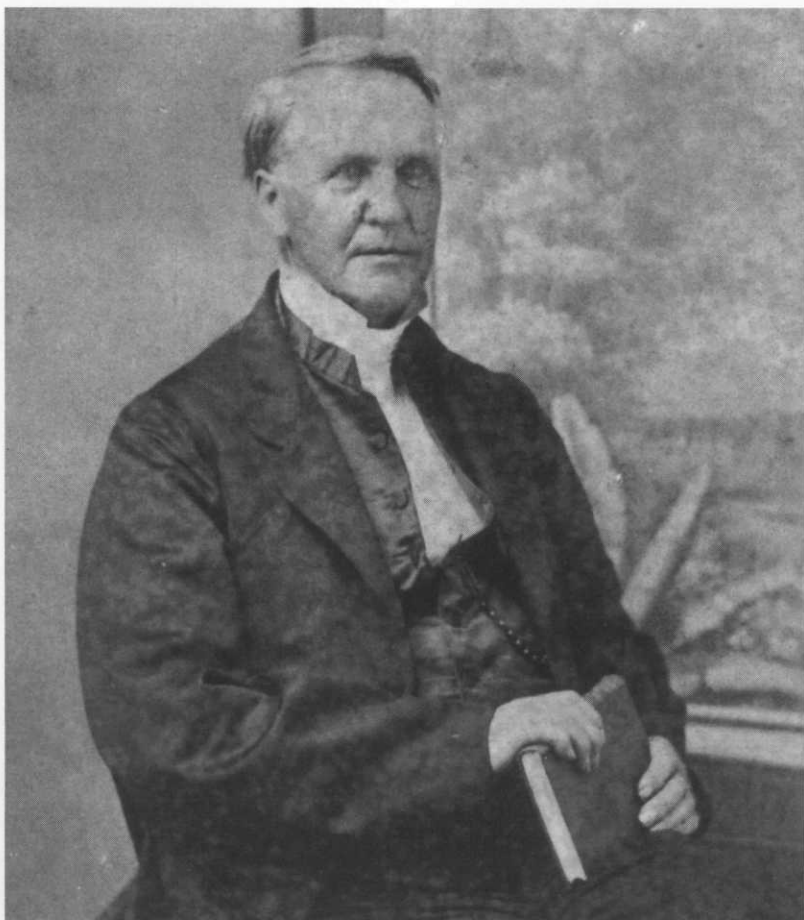


FIG. 1. The Rev. Titus Coan saw nearly every eruption of Mauna Loa and Kilauea from 1835 to 1882 and wrote extensively about the volcanoes. (Hawaiian Historical Society)

Hawaiian ferns and fishes respectively;¹⁶ and Ursula Emerson and Lorrin Andrews put their hands to mapmaking.¹⁷ Mrs. Emerson was responsible for the oldest surviving manuscript maps of Hawai'i; Andrews adapted a method of copperplate engraving to serve the printing press at Lahainaluna school, which reproduced Mrs. Emerson's maps and others which he himself made. Though not within the parameters of published communication, there are numerous

letters from the pioneer missionaries recording dispatch of lava, shells, and dried plants to scientists in the United States for identification and comment. Some of these contributions were listed in the *Proceedings of the Boston Society of Natural History*.¹⁸

The second-generation missionaries carried the naturalist tradition of their parents into a new century. Their seventy-seven articles on the volcano comprise 55 percent of their publications in contrast to the ninety-one volcano articles making up 90 percent of their parents' bibliographic record. The most active of the volcano watchers were Henry M. Whitney (fifteen publications), the Rev. Sereno E. Bishop (twelve), David H. Hitchcock (seven), William D. Alexander (six), and Frederick S. Lyman (six); together they provided more than half of the publications.¹⁹ The now famous Hawaiian landshells account for nearly 25 percent of the of the bibliographic references, challenging the popularity of the volcano. Interest in the colorful, gemlike achatinelline tree snails engendered not only the collection of thousands of shells, but nearly fifty species descriptions in scientific journals. These descriptions by David Dwight Baldwin and John T. Gulick between 1820 and 1912²⁰ represent about 40 percent of all achatinelline descriptions in that period, for professional malacologists in Europe and the United States were also busy describing Hawaiian achatinellines.

The second-generation missionaries also engaged in the study of birds, botany, climate, geology, and soils. Eleven species of native birds painted from life by Titus Coan's daughter, Harriet Fidelia Coan, about 1860 now grace the collections of Lyman House Memorial Museum in Hilo. The first list of native birds was published in 1869 in Boston by Sanford Ballard Dole and updated in the *Hawaiian Annual* in 1873; a third list was published by Albert B. Lyons in 1890.²¹ The botanical papers include lists of ferns and mosses by D. D. Baldwin and A. B. Lyons and seaweeds by Jeremiah Chamberlain.²² Other substantial papers published between 1867 and 1907 were the work of Sereno E. Bishop,²³ who was perhaps the most versatile of the missionary naturalists, writing not only on the volcano but on climate, ocean currents, and geography, and of the Lyons brothers, A. B. Lyons publishing on geology and soils and Curtis J. Lyons on climate, rainfall, and tides.²⁴

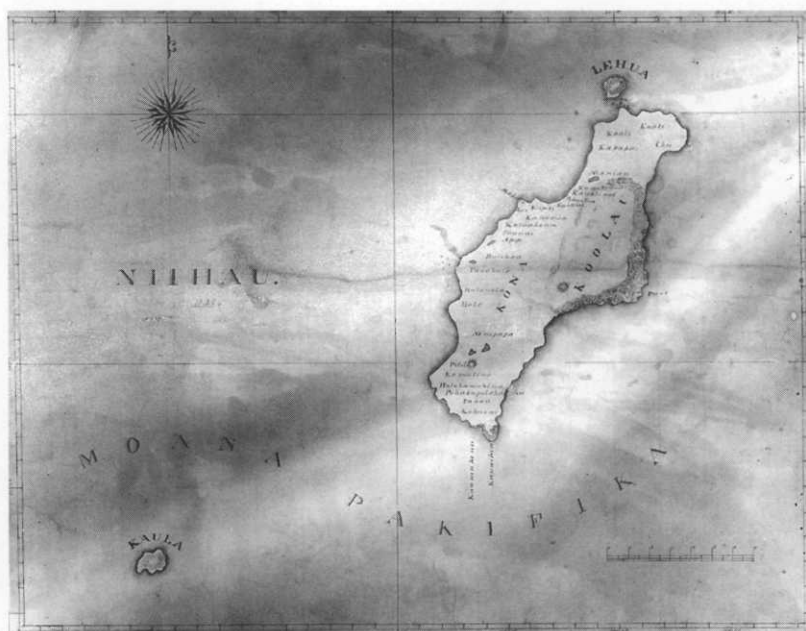


FIG. 2. Ursula S. Emerson's map of the island of Ni'ihau, drawn sometime after 1833 on the basis of J. Denison's large-scale wall map of the Hawaiian Islands, commissioned that year by the Sandwich Islands Mission. (Hawaiian Historical Society)

THE NEW ENGLAND HERITAGE

Answers to why and how the missionaries, parents and children, assembled such a remarkable record of information about Hawaiian natural history lie in their New England heritage, their education, their continuing bond with New England, and in an innate love of nature associated with the natural theology embraced by Congregationalists of the day. The study of God's creations was another route to the understanding of God.

The eighty missionaries who arrived in Hawai'i between 1820 and 1860 were extraordinarily well educated.²⁵ More than 80 percent of the men had at least one year of university study, and more frequently a degree, prior to study in a theological seminary. Eight of the mission fathers claimed Amherst as alma mater; seven attended Yale; six graduated from Williams; fifteen were divided among

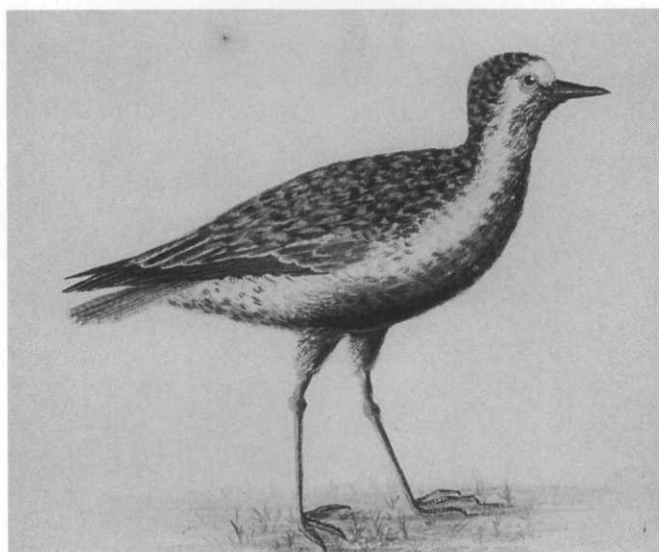
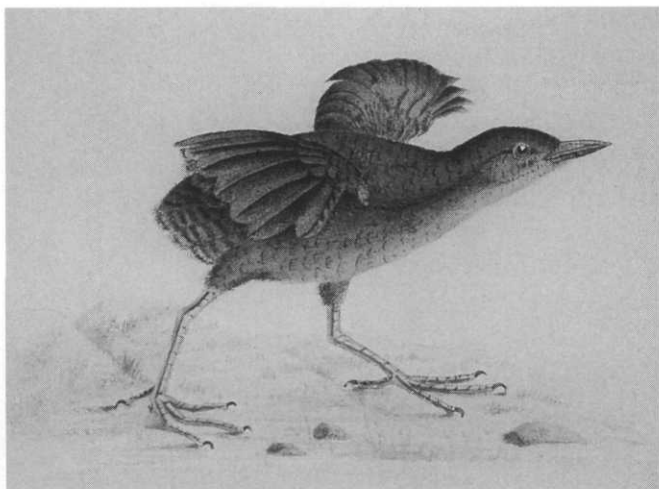


FIG. 3. Two of eight species of birds painted by Harriet Coan (1839–1906) in Hilo, probably about 1860. *Top*: Moho, the Hawaiian Rail, *Porzana sandwichensis*, a small (5.5 inches in length) flightless bird known only from the island of Hawai'i on the grassy uplands adjacent to forests. It was last seen alive about 1894. *Bottom*: Kōlea, the Pacific Golden Plover, *Pluvialis fulva*, which journeys more than two thousand miles each August from its breeding grounds in Siberia and Alaska to Hawai'i and returns to its nesting grounds in April. (Photos courtesy of the Lyman House Memorial Museum)

Bowdoin, Union, Middlebury, Princeton, and Dartmouth, and all but four of the remaining missionaries were in colleges from Dickinson to Jefferson. The women were also well educated for the day: 19 percent attended one of the recently established female seminaries after common school, five of them at Mt. Holyoke; 25 percent taught school before they embarked for Hawai'i.

Five centers of natural-history teaching in early nineteenth-century New England colleges are well known:²⁶ Yale, where Benjamin Silliman, interested especially in geology and mineralogy, was a gifted teacher and founder of the *American Journal of Science*; Amherst, where Silliman's student Edward Hitchcock was professor of geology and president; Williams, with an astronomical and magnetic observatory; Bowdoin, with the geologist Parker Cleaveland; and Harvard, where chemistry, botany, and geology were taught in the medical school. It is perhaps no coincidence that thirteen (nearly 30 percent) of the mission fathers were among the students at four of those institutions before going on to theological seminary.

Nor were the women excluded from the natural-history tradition.²⁷ The most prominent sponsor of women's education in science in New England was Mary Lyon, one of the few women to attend classes at Amherst and the founder of Mount Holyoke Seminary (later College). Julia Spaulding of the Fifth Company was one of Mary Lyon's earliest pupils,²⁸ and several of the second-generation missionary women attended Mount Holyoke. One of the pioneer mission women, Anna Leadingham, was a graduate of Oberlin.²⁹ Juliette Montague Cooke attended lectures at Amherst.³⁰ Mary Parker applied to be permitted to take the college course at Yale in 1830 but was denied, although several professors let her slip quietly into their classrooms and she eventually took their examinations.³¹

The education of both the men and the women may well have been built on an inherent love of nature. That appreciation emerges quite unpredictably in journals and letters in the midst of otherwise the most prosaic of verbiage. Elisha Loomis described Mānoa Valley as "the most picturesque and romantic scenery I . . . ever beheld . . . it is here a perpetual Spring. The ground . . . covered with trees, shrubs and a luxuriant foliage, always green and the woods enlivened by the sweet notes of birds. . . ."³² Titus Coan told James D. Dana of his

feelings for Hilo: "In a few days . . . our beauteous Hilo [may be] no more—that our lovely, our inimitable landscape, our emerald bowers, our crescent strand and our silver bay are blotted out. . . ." These themes are echoed in reminiscences and letters. Among Sarah Lyman's earliest recollections in New England were "a passion for rambling . . . alone in search of the earliest wild flowers and mosses in the spring, for berries in the summer and for nuts in the autumn."³³ A. B. Lyons wrote of his mother, "who, without education herself beyond the common school, had nevertheless a keen interest in nature . . . she made botany . . . a living and fascinating study. . . ."³⁴

In Hawai'i, time and distance (more than 120 days and thousands of miles' travel by ship) from the New England heritage were spanned by letters, not just to family but to former teachers. Boxes of corals, shells, and lava were packed and sent "home" for identification. Dwight Baldwin, about 1846, sent a box of coral and twenty numbered lava specimens gathered by son David Dwight to Professor Silliman at Yale;³⁵ and David Dwight himself thirty years later acknowledged his indebtedness to Professor Eaton, also at Yale, for the identification of some mosses.³⁶ S. C. Damon maintained contact with his Amherst geology professor, Edward Hitchcock, recalling geology lessons and Hitchcock's teaching in editorials in *The Friend*.³⁷ John Diell of the American Seaman's Chapel sent small collections of plants to Professor Asa Gray at Harvard;³⁸ the Rev. Charles S. Stewart's parcel of shells to Jacob Green in Philadelphia included two shells representing the first two species of the tree snails, *Achatinella*, to be described in the United States.³⁹ Henry Dimond in Honolulu provided shells for members of the U.S. Exploring Expedition,⁴⁰ and the Reverend Johnson at Waioli sent shells to Jesse Wedgewood Mighels in Maine.⁴¹ The seaweeds listed by Jeremiah Chamberlain were collected "at the request of Asa Gray" at Harvard.⁴²

Letters to Professor Silliman at Yale were often printed in the *American Journal of Science*. The first of these letters, Goodrich's "Notice of the volcanic character of the island of Hawaii," was published with a note of effusive praise by Silliman.⁴³ Goodrich's third published letter to Silliman was about Kilauea, and with it, Goodrich forwarded a box of the lava, "all the specimens . . . taken either hot or warm from the bottom of the crater."⁴⁴ In the letter, Goodrich

described enormous six-sided prisms in the crater, noting they were similar to “the trap of East and West rock, near New Haven,” to which Silliman, ever the teacher, added a footnote, “With which Mr. Goodrich was familiar while at College.”

There were occasions when the mission family asked for help, especially for books and instruments, and even offered to pay for the items themselves. Dr. Baldwin, writing that he was “about to prepare something in the native language for some of the schools to study botany . . . [needed] a general description of the plants of the world . . . either in English, Latin or French. I intend to save the sum one way or another, from all the allowance to which I shall be entitled.”⁴⁵ Rufus Anderson in Hilo in 1847 wrote the Board of Commissioners “we have just arrived at the place where a Telescope would be of great value . . . it would open a new book . . . to pupils of the Boarding School. . . .”⁴⁶ Lucy Wilcox on Kaua‘i, making a shopping list for Abner on his way to Honolulu and the mission depository, included “2 dolls, 4 knives, a microscope, . . . and ½ bbl of cheese. . . .”⁴⁷

Several libraries were assembled to meet the needs of both education and reference.⁴⁸ When Dr. Baldwin moved from Kailua, Hawai‘i, to Lahaina, Maui, his library of 125 books moved with the family and grew over the years to 200 volumes, including Linnaeus’ *Insects*, Paley’s *Natural Theology*, and Eaton’s *Botanical Dictionary*. Goodrich in Hilo had Cleaveland’s *Mineralogy*, Henry’s *Chemistry*, Lee’s *Botany*, and the *American Journal of Science*, and John T. Gulick between 1853 and 1855 acquired Darwin’s *Journal of the Voyage of the Beagle*, Hooker’s *Introduction to the Flora of Tasmania*, Swainson on geographical distribution, and Gould’s and Agassiz’s *Zoology*.

Of course the missionaries were not the only Westerners in Hawai‘i. Visiting naturalists—Darwin’s collectors—arrived in a continuing stream, their travels around the islands documented in mission journals. In 1825, C. S. Stewart wrote of meeting Mr. Hoffmann, mineralogist on board the Russian ship *Predpriatie* with Captain Kotzebue, and that he “makes his home with us.”⁴⁹ In 1833, Mrs. Emerson at Wailua, O‘ahu, rose early to see Meredith Gairdner, the young Edinburgh-trained doctor en route to the Hudson’s Bay Company, off on his way up Mt. Ka‘ala;⁵⁰ and the Scottish botanist David Douglas was a guest of the Goodrich and Lyman families in Hilo.⁵¹ In

1835, Thomas Nuttall and John K. Townsend, on an expedition to collect birds and plants, visited the Peter Gulicks at Waimea, Kaua'i.⁵² Most members of the U.S. Exploring Expedition of 1840–1841 found someone with whom to stay; and, indeed, it was on that visit that the lifelong friendship of one of the world's greatest geologists, James Dana, and the volcano-watching preacher, Titus Coan, was established.⁵³ Dr. Judd was entrusted with the execution of the Exploring Expedition ascent of Mauna Loa; he organized food and shelter for three hundred people who spent twenty-eight days on the mountain and forty-two days away from Hilo, "the whole operation proceeding without a hitch."⁵⁴ Dr. Baldwin wrote from Lahaina of "the pleasure of having all the scientific corps . . . with us. . . . They lodged at our houses & lived at our tables. . . . Two of them were accomplished botanists, & afforded me more assistance as to vegetable productions of this part of the world than all I have had from other sources since I have been in the islands."⁵⁵

By mid-century in Honolulu, missionaries and other residents were emulating a practice recently established in New England of popularizing science by forming small organizations, "the lyceum," for "mutual improvement and the collection of information." This was the purpose of The Sandwich Islands Institute.⁵⁶ The inaugural address was delivered 12 December 1838 by vice-president Dr. T.C.B. Rooke, with at least fourteen of the mission among its members. The group was "to meet with unshackled cordiality; to develop a library [the treasury had no funds], to support essays, addresses, discussions and debates." Every member would present an essay annually at meetings on alternate Tuesday nights. A quarterly magazine, *The Hawaiian Spectator*, was issued for six months before the institute folded. Other organizations in the lyceum format that included members of the mission were the Royal Hawaiian Agricultural Society,⁵⁷ founded in 1850 with twenty-eight of the missionary fathers and three sons on the first membership list, and the Hawaiian Medical Association,⁵⁸ with Dr. Judd one of the ten physicians who signed the charter of incorporation in 1856. A "microscopical association" was announced on the front page of *The Friend* 1 April 1875, and a subscription list circulated to "procure a microscope of high power."⁵⁹ "Seventeen of Honolulu's more serious-minded gentle-

men," among them the missionary son C. J. Lyons, as secretary, and three others of the mission family, paid their subscriptions. Pledges of \$800.00 were made, and plans were drawn up for ordering a microscope, but nothing more was heard of the organization. Of the fourteen original members of the Social Science Association, convened by the Rev. C. M. Hyde in 1880, ten were of the mission family.⁶⁰ The Honolulu Medical Association and the Social Science Association persist today.

The popularity of natural science among the mission families follows from the description of one Honolulu visitor who described an "evening . . . spent in agreeable conversation. Scientific subjects are not unfamiliar. . . . Several . . . missionary ladies . . . have handsome collections of shells, and specimens in mineralogy and geology . . . there is but very little of the 'azure hose or blue stocking club' discernible in the conversation of these women, [but] occasionally they may venture to hint the scientific name of some shell. . . ." ⁶¹

WE ARE OBLIGED TO EDUCATE OUR OWN CHILDREN

Dr. Baldwin's concern for his children's education reflects that of all the mission families: "I do not know the scientific names of $\frac{1}{2}$ of the plants growing about my door. . . . I cannot tell our children of the names of the plants which grow luxuriantly in their yard . . . it is no small burden that rests upon us, that we are obliged to educate our own children."⁶² The choices were to send them home to New England or to keep them in the Islands, where they would be taught at home until Punahou School was established in 1841. In Kailua, Kona, the youngsters who had not been sent back to New England visited at the Reverend Bishop's, where they picked out on a globe, and in the evening sky, some of the constellations, the larger planets, and stars and where an orrery "had five moons in lively revolution."⁶³ In Hilo, Sarah Lyman was "in the habit of showing . . . the pictures in Oliver Goldsmith's *Natural History*" to at least one of her sons, who recalled that he "was able to recognize the pictures of every animal before I could utter its name."⁶⁴ In Waimea, A. B. Lyons's mother stimulated him while in preparatory school to write compositions on "The Ocean," "The Plurality of Worlds," and "The Six Days of

Creation," and he recalled evenings at home while his mother sewed, and he read aloud to her, "among other books on popular science, Captain Maury's *Physical Geography of the Sea*. . . ." ⁶⁵

At Punahou School, the curriculum emulated that of schools in New England: reading, geography, spelling, writing, and arithmetic for the younger children; Greek and Latin, natural philosophy (elementary physics), geometry, astronomy, surveying, and in 1859, botany, for the older students.⁶⁶ Perhaps because in those early Punahou days "dancing was under ban; marbles, chess and cards were tabu . . . and football was unknown,"⁶⁷ almost more is known of weekend and vacation activities than of the schoolroom, for the boys were wont to ramble high in the hills around Mānoa, naming the various peaks (Tantalus, for example) and collecting shells and ferns. Botanical collecting tins for young Alexanders and Lymans were provided by Dr. T.C.B. Rooke, an English physician and stepfather of Queen Emma, and Dr. Hillebrand, a resident physician. The boys hauled them up and down the ridges of west Maui in 1851, discovering, among other things, a "blue Lobelia."⁶⁸ On returning to Honolulu, they identified it with the help of Rooke's botanical library.

The mission children were early enthralled with land shells, collecting them by the quart in 1835, when Lucy Thurston wrote that "we have each a drawer of shells, a pair of as many kinds as we have been able to collect," and of "an excursion to . . . Manoa. . . . We gathered nearly a quart of Stewart shells . . . adhering to the *ki* leaves. . . . There are two species. One is named *Oahuensis* because they were first found in Oahu, the other *Stewartii*, as Mr. Stewart was the first who ever carried them to America. . . ." ⁶⁹ By the early 1850s virtually all the boys had succumbed:⁷⁰ the Reverend Alexander said of his sons in 1852 that they were "all infected with a conchological fever, and daily traverse the ravines in quest of land shells"; Dr. Baldwin warned his daughter Abby in 1853 that her brothers "Charles and Henry are catching the fever"; and Charles Wilcox (1853) wrote his father on Kaua'i, "I wish you would send me some large black land shells. . . . All the Punahou boys have got a fever for land shells. . . ." The fever became a passion for some of them. John T. Gulick wrote on 21 April 1853 of becoming "very much interested in

collecting *Achatinella*. . . ,”⁷¹ visiting with Dr. Newcomb, resident physician at Queen’s Hospital, and Mr. Frick, the French consul, who were also collecting *achatinellines*. As an early evolutionist, Gulick wrote some twenty papers on their evolution. D. D. Baldwin, apparently sharing the fever with his brothers, spent the greater part of his life studying those shells and produced the first catalogue of Hawaiian land shells.⁷²

Volcano watching was another sport, albeit the Hawai’i boys who were at Punahou on O’ahu rarely saw their beloved volcanoes during the school year. In January 1859, however, “without any seismic prelude,” “smoke” was seen rising from Mauna Loa, presaging perhaps the greatest eruption the missionaries were to witness. The older boys at Punahou petitioned the faculty for a field trip, a schooner was chartered for three weeks, and twenty-two boys and their teachers left for Kona.⁷³ Ten of the boys made it up the mountain, where “the twin craters emitted a bright light, . . . sent up immense columns of steam . . . showers of red-hot pumice, with a noise like the roar of heavy surf . . . occasionally like discharges of artillery . . . [and] a grand cataract of fire . . . rolled down the mountain side.”

If college records are a measure of the success of a homegrown education, the missionary parents exceeded beyond expectation. Of the fourteen missionary sons for whom records are available, ten went to Williams College, two to Yale, and one each to Amherst and Princeton. At Yale, W. D. Alexander was a Phi Beta Kappa and salutarian of his class, and D. D. Baldwin received the first astronomical prize;⁷⁴ at Williams, A. B. Lyons and Henry Lyman were valedictorians of their respective classes, and J. T. Gulick graduated with honors;⁷⁵ David B. Lyman, Jr., was awarded a prize for an essay. A. B. Lyons received his M.D. degree from the University of Michigan and after teaching in Michigan became professor of chemistry at Punahou.⁷⁶ He returned to Michigan as head of a chemical company and was secretary of the scientific section of the American Pharmaceutical Association and a fellow of the Royal Chemical Society of London. C. J. Lyons, “the father of the Hawaiian weather bureau,” was appointed a government surveyor at age seventeen and eventually government meteorologist.⁷⁷ W. D. Alexander was a professional surveyor and was honored as a fellow of the Royal Geographical Society.⁷⁸ S. E. Bishop achieved

international recognition by explaining a series of magnificent sunsets and after-glows visible suddenly in Honolulu on 1 September 1883.⁷⁹ Using published data on the same phenomena from other parts of the world, Bishop was awarded the Third Warner Prize for his essay explaining their origin as from "the great eruption of the crater of Krakatoa . . . in the Straits of Sunda, on 27th of August, 1883." Bishop's rings, halo-like rings with a metallic glitter sometimes appearing around the sun, are also named after him.

THE SIGNIFICANCE OF THE MISSIONARY REPORTS

How the missionary contributions to Hawaiian natural history compare with those of Darwin's collectors can perhaps be no better seen than in the story that Adelbert von Chamisso, naturalist on the Russian ship *Rurick* in Honolulu in 1816, told on himself. He was wandering through Nu'uau Valley when, on the banks of a taro patch, he came upon a

beautiful grass that I could not remember having previously seen, and of which I forthwith picked some samples. As I was thus occupied, an O-whaihan met me, seized me, and berated me . . . I related the incident to Mr. Marini [Marin] and showed him the grass. The man was his tenant, the grass was rice, . . . Let botanists laugh at me, the same thing might have happened to any one of them. In the herbarium I had not mistaken *Oryza sativa*.⁸⁰

Darwin's collectors and the missionaries were all strangers in a strange land. The missionaries may not have had some of the more professional touches of the naturalist-explorers, but they did have the advantage of being in the Islands for long periods of time: they saw the volcano on a daily basis; they studied "our ferns in their localities and seasons, which vary, . . . through the entire year;"⁸¹ they looked not at empty shells but at land snails in place on the leaves of trees; and they had time to explore not only the active volcanoes but the older mountains of Kaua'i and Maui.

Titus Coan and others of the volcano watchers produced long and detailed accounts of activity of both Kilauea and Mauna Loa, descrip-

tions that serve volcanologists well today in interpreting the history of the volcanoes.⁸² The fifty years of records Sarah Lyman kept of earthquakes she felt in Hilo have been quantified and set into the activity curves of earthquakes constructed by modern volcanologists. Mrs. Lyman "reported three to four earthquakes a year until the great Kau earthquake in 1868, after which the count increased to double-digit numbers for about a decade."⁸³ Nor should her ingenuity in quantifying the strength of those earthquakes, by counting the number of pieces of china that fell from her shelves, go without mention. C. J. Lyons's meticulous records of barometric pressure, maintained for more than twenty years at the beginning of this century,⁸⁴ and the temperature records of the Reverend Richards in Lahaina between 1828 and 1838 provide extraordinarily useful information on past climatic conditions.⁸⁵

The opportunity to volcano watch on an almost daily basis resulted in several significant "firsts" which were recognized by Wright and Takahashi:⁸⁶ Titus Coan was the first to describe the inflation process on a volcano as occurring within minutes as he watched a man standing over an inflating tube and barely getting off in time; C. S. Lyman correctly identified endogenous uplift on the Kilauea caldera floor; and W. D. Alexander recognized that because 'a'ā and pāhoehoe occurred in the same eruption their origin could not be due to differences in the magma prior to eruption and suggested the formation of 'a'ā was similar to "sugaring," now explained by crystallization when lava is undercooled. Other "firsts" recorded by the observant missionaries were Elisha Loomis's description as he climbed Kilauea in 1824 of "ohia and lehua, whose beautiful red blossoms furnished food for innumerable small birds,"⁸⁷ and S. E. Bishop's note on the effects of an apparently recently introduced species in Lahaina in the 1850s when kou trees, "the most beautiful tree in the Hawaiian Islands," were infested by "a minute insect called 'red spider,' which attacked the under surface of the leaves such that in a year every kou tree, not only in Lahaina but throughout the group was destroyed."⁸⁸

Many of the observations recorded between 1820 and 1916 serve as yardsticks today, providing measures of change in landscapes, vegetation, and in the biota. Goodrich's description of the vegetation zones on Mauna Kea was of

three or four different regions in passing from the sea shore to the summit. The first . . . five or six miles, where cultivation is carried on, . . . Brakes, a species of fern, . . . grow to the size of trees; . . . The woody region. . . The region higher up produces grass, . . . Strawberries, raspberries, . . . and herds of wild cattle are seen grazing.⁸⁹

What he tells us is that treeline was lower and more diversified than it is today, and that the cattle released by Captain Vancouver had reproduced prodigiously in the thirty years since their 1804 introduction. Virtually every missionary writing of an excursion, whether up Mānoa Valley, to the crater at Kilauea, or through the lava fields in Puna, tells of the enchantment of the sounds of birds.⁹⁰

The first-generation missionaries were also close enough in time and had the language to record firsthand accounts of events in Hawai'i prior to 1778. Edward Bailey learned of the fall of a meteor on Lāna'i and of a great eruption of lava on the slopes of Haleakalā from informants,⁹¹ as did Elisha Loomis of the death of Captain Cook.⁹² Sereno Bishop wrote of "old memories" of central O'ahu in the 1830s that described the upland beyond Kipapa gulch as "dotted with occasional groves of Koa trees," masses of plants on the high plains, and the memory of a forest that formerly covered the whole of those plains burned off in the search for sandalwood, detected by its odor when burning.⁹³

The volcano bibliographers Wright and Takahashi suggest that the missionary volcano watchers were "unfettered by scientific theories," that they reported their observations as they saw them, not as they "should be" according to theory.⁹⁴ They cite the controversy between James Dana and his great friend Titus Coan as an example. Coan's concept of lava flows was simply that of observation, "lavas flowing from an orifice in a broad stream down the mountain." Dana's proposal was that an "internal force" produced "fissures opening to the fires below . . . [that] afforded accessions to the fiery flood."⁹⁵ Dana eventually changed his mind, but it was not until several years after Coan's death.

The missionary evolutionist J. T. Gulick was similarly "unfettered by scientific theories."⁹⁶ With large collections of land shells at hand, he was among the first to recognize that each of the islands has a sep-

arate set of species; that on O'ahu each valley has its own species; and that the degree of difference between several species of the same group was proportional to the distance they are separated from one another. However, when Gulick, aware of Darwin's *Origin of Species*, attempted to explain these distribution patterns in terms of the theory of natural selection, that is, that food, climate, and enemies act in keeping species separate, he realized that the O'ahu landsnails were on the same side of the mountain, with the same food, climate, and enemies. The only thing that would make a difference was that they were separated by space, and he proposed isolation itself as a major factor in the origin of species. Gulick visited Darwin at Down House in 1872,⁹⁷ described his work and ideas, but found Darwin less than happy to have isolation play a major role in his theory, although Gulick's perceptions have since been recognized and are today incorporated in evolutionary theory.⁹⁸

CONCLUSION

Between 1820, when the missionaries arrived in Hawai'i, and the first decade of the twentieth century, natural history had been transformed from descriptive narrative into the discipline championed by Charles Darwin, which recognizes that animals and plants, in accord with their habits and habitats, change over time. S. E. Bishop, born in Hawai'i within "only a few rods from the rock where Captain Cook was slain,"⁹⁹ elegantly captured not only the transition but the perceptiveness of the missionaries themselves in a succinct summary of the natural science of his childhood:

Of geology we never heard. The globe had been created in six ordinary days, and there was no mystery about it. Still we got a grounding in scientific ideas which opened the way for the broader modern outlook. We had some notion of the spatial immensity revealed by astronomy, but none of the immensity of time as now disclosed. Six thousand years was the limit of past earthly chronology.

The transition from the old ways of thought to the "broader modern outlook" was clearly evident within the mission family. Dr. Judd liter-

ally dismissed Meredith Gairdner's "interesting question" out of hand in 1839, when the young medical doctor, touring O'ahu for a few days, asked how the limestone cliffs in the vicinity of Kahuku attained their present position: "their summits are elevated . . . fifty feet above the highest level reached now by the sea. They must have been under water at the time of their formation, for coral never increases above the surface."¹⁰⁰ Dr. Judd's response was that "The question at once loses its interest on the supposition that these cliffs are formed of the concrete sand, . . . easily . . . elevated to its height by the wind and consolidated in that position. . . ."¹⁰¹ But neither E. O. Hall, who had seen the Kahuku cliffs, nor Titus Coan, who had discussed fossilized coral reefs with James Dwight Dana, had problems with the earth's chronology.¹⁰² Coan, describing his volcanoes, frequently wrote of "time immemorial"¹⁰³ and would have been pleased by A. B. Lyons's description of occasional changes in sea level when coral reefs would be added to dry land, of the lowland regions of the older islands with strata of fossiliferous limestone, and conclusion that "elevation of the land (or recession of the ocean) had taken place at a very recent of period in geological time."¹⁰⁴

The contributions of the missionary parents to the natural history of Hawai'i are largely descriptive, in keeping with the natural history of the era immediately subsequent to the Linnaean revolution in taxonomy when science was primarily descriptive. The second generation, equally in keeping with its time, went beyond the bounds of description to challenge the tenets of the past. S. E. Bishop, speculated not only on the phenomena of the atmosphere but on the origins of Hawai'i's unique plants: "I fancy that the seeds of these berries [akala, or raspberry] had been at some time transported from the abounding berry fields of the American coast by migratory geese or other birds to whose feet or feathers they had become attached."¹⁰⁵ J. T. Gulick as an eighteen-year-old school boy recognized the phenomenon of insular endemism and was to later declare "these achatinellinae never came from Noah's ark."¹⁰⁶ Together, the two generations provide a remarkable compilation of nearly one hundred years of observation and theory of the natural history of the most isolated islands in the world, and thereby a record perhaps without parallel.

NOTES

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¹ Frederick Burkhardt and Sydney Smith, *The Correspondence of Charles Darwin* (Cambridge: Cambridge UP, 1984) 7: 454. The Cambridge ornithologist Alfred Newton was even more blunt than Darwin—"The Sandwich Isles have not been fortunate in their Natural Historians"—although Newton did notice S. B. Dole's "Synopsis of the Birds. . . ." as "a serviceable foundation for future work" and "an honest piece of work, doing credit to its compiler." "Ornithology of the Sandwich Isles," *Nature* (March 17, 1892): 465, 467.

² E. Alison Kay, "Darwin's Biogeography and the Oceanic Islands of the Central Pacific, 1859-1909," *Darwin's Laboratory: Evolutionary Theory and Natural History in the Pacific*, ed. Roy M. MacLeod and Philip F. Rehbock (Honolulu: U of Hawai'i P, 1995) 49-69.

³ The missionaries included here are those listed in HMCS, *Missionary Album* (Honolulu: HMCS, 1969), and, in addition, Chester S. Lyman and Rufus Anderson.

⁴ Joseph Goodrich, "Letter," in Benjamin Silliman, "Notice of the volcanic character of the Island of Hawaii, in a letter to the Editor, and of various facts connected with late observations of the christian Missionaries in that country, abstracted from a Journal of a Tour around Hawaii, the largest of the Sandwich Islands," *American Journal of Science* 1st Ser., 11 (1826): 5.

⁵ Thomas L. Wright and Taeko Jane Takahashi, *Observations and Interpretation of Hawaiian Volcanism and Seismicity 1779-1955* (Honolulu: U of Hawai'i P, 1989) 213-19.

⁶ Gerrit P. Judd III, *Dr. Judd, Hawaii's Friend: A Biography of Gerrit Parmele Judd, 1803-1873* (Honolulu: U of Hawai'i P, 1960) 101-102; Henry M. Lyman, *Hawaiian Yesterdays* (Chicago: A. C. McClurg, 1906) 54.

⁷ William Ellis, *Narrative of a Tour through Hawaii, or, Owhyhee* (London: H. Fisher, Son and P. Jackson, 1825).

⁸ Goodrich, "Letter," in Silliman, "Notice," 4; Walther M. Barnard, "Earliest Ascents of Mauna Loa Volcano, Hawai'i," *HJH* 25 (1991): 68.

⁹ Wright and Takahashi, *Observations* 49-55.

¹⁰ William T. Brigham, "The Volcanoes of Kilauea and Mauna Loa," *Memoirs Bishop Museum* 2.4 (1909): 50; Charles H. Hitchcock, *Hawaii and Its Volcanoes* (Honolulu: Hawaiian Gazette, 1911) 302.

¹¹ Wright and Takahashi, *Observations* 48-49, 56; Fidelia C. Coan, "Eruption from the summit of Mauna Loa, Hawaii," *American Journal of Science*, 2nd ser., 14 (1852): 106-107.

- ¹² Max Wyss, Robert Y. Koyanagi, and Doak C. Cox, "The Lyman Hawaiian Earthquake Diary, 1833-1917," *U.S. Geological Survey*, 2027 (1992): 1-12. A page of records 1833-1841 is figured in Charles Wilkes, *Narrative of the United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842* (Philadelphia: Lea and Blorched, 1845) 4: 229, but Wilkes says that Mr. Lyman (*italics mine*) gave the records to him from "his memorandum." The letter "A Record of the Earthquakes, Kept at Hilo, Hawaii," *American Journal of Science*, ser. 2, 7 (1859): 264-66, is credited to "S. C. Lyman."
- ¹³ Lists of the authors and their publications are deposited in the Hawaiian Historical Society Library, Hawaiian Mission Children's Society Library, and the University of Hawai'i Library.
- ¹⁴ Gerrit P. Judd, "Review of Meredith Gairdner, Physico-Geognostic Sketch of the Island of Oahu, one of the Sandwich Group," *Hawaiian Spectator* 1.2 (1837): footnotes 6-17; Dwight Baldwin, "Review; A Narrative of Missionary Enterprise in the South Sea Islands; . . . by John Williams," *Hawaiian Spectator* 2.3 (1839): 241-75.
- ¹⁵ Hiram Bingham, "Particulars of the Fall of Meteorites in the Sandwich Islands," *American Journal of Science* 1st ser., 49 (1845): 407-408.
- ¹⁶ Edward Bailey, "Hawaiian Ferns. A Synopsis," *HAA* (1882): III-IV, 5-62; Charles H. Wetmore, "Concerning Hawaiian Fishes." *HAA* (1889): 90-97.
- ¹⁷ Gary L. Fitzpatrick, *The Early Mapping of Hawaii*, vol. 1, *Palapala'aina* (Honolulu: Editions Limited, 1986) 106-109.
- ¹⁸ *Proceedings Boston Society of Natural History*, 19 Apr. 1843: 111; Artemas Bishop and Lorrin Andrews both responded in depth to Lewis Henry Morgan's questionnaire on kinship in the Hawaiian islands. A. Spoehr, "Lewis Henry Morgan and his Pacific Collaborators," *Proc. of the American Philosophical Society* 125 (1981): 451, 452.
- ¹⁹ Wright and Takahashi, *Observations* 213-19.
- ²⁰ Robert H. Cowie, Neal L. Evenhuis, and Carl C. Christensen, *Catalog of the Native Land and Freshwater Molluscs of the Hawaiian Islands* (Leiden: Backhuys Publishers, 1995); Henry A. Pilsbry and C. M. Cooke, Jr., *Manual of Conchology. Structural and Systematic. With illustrations of the species. Second Series: Pulmonata*. Vol. XXII. Achatinellidae (Philadelphia: Academy of Natural Sciences, 1912-1914); Addison Gulick, *John Thomas Gulick, Evolutionist and Missionary* (Chicago: U of Chicago P, 1932) 511-14. A third-generation missionary son, C. M. Cooke, Jr., a professionally trained malacologist, succeeded Baldwin and Gulick in the publication game in 1912 when he was appointed curator of malacology at Bernice P. Bishop Museum in Honolulu and in his lifetime was author or co-author of nearly four hundred species of Hawaiian land snails. Yoshio Kondo and William J. Clench, "Charles Montague Cooke, Jr., A Bio-Bibliography," *Bernice P. Bishop Museum Special Publication* 42 (1952): 31-56.
- ²¹ Sanford Ballard Dole, "A Synopsis of the Birds Hitherto Described from the Hawaiian Islands. With Notes," *Proceedings Boston Society Natural History* 12 (1869): 294-309; "List of Birds of the Hawaiian Islands," *HAA* (1878): 41-58

- (reprinted in H. W. Nicholson, *From Sword to Ploughshare: or a Fortune in Five Years in Hawaii*, 1889, 304–319); Albert B. Lyons, "List of Birds," *F* (1890): 90–91.
- ²² David D. Baldwin, "List of Hawaiian Mosses and Hepaticae," *HAA* (1876): 40–42; Albert B. Lyons, "Artificial Key to the Genera and Species of Hawaiian Ferns," *HAA* (1890): 76–87; Jeremiah E. Chamberlain, "Algae of the Hawaiian Islands," *HAA* (1880): 32–39. (Baldwin and Chamberlain reprinted in Nicholson, *From Sword*, 302–404, 298–300).
- ²³ Sereno E. Bishop, "Causes of the Peculiarity of Hawaiian Climate," *HAA* (1880): 44–49. "The Haze from Java," *HAA* (1883): 46–48; "Geology of Oahu," *HAA* (1901): 59–73.
- ²⁴ Albert B. Lyons, "Geology of the Islands," *HG* 19 Jan. 1894: 6; "Chemical Composition of Hawaiian Soils," *American Journal of Science* 4th ser., 2 (1896): 421–29; Curtis J. Lyons, "The Tides," *HAA* (1874): 31–32; "Features of Hawaiian Climate," *HAA* (1894): 63–70.
- ²⁵ Data from Robert Benedetto, *The Hawaiian Journals of the New England Missionaries 1813–1894. A Guide to the Holdings of the Hawaiian Mission Children's Society Library* (1982); HMCS, *Missionary Album*; LaRue W. Piercy, *Hawaii's Missionary Saga* (Honolulu: Mutual Publishing, 1992); Patricia Grimshaw, "New England Missionary Wives, Hawaiian Women, and 'The Cult of True Womanhood,'" *HJH* 19 (1985): 73, 79; Patricia Grimshaw, *Paths of Duty* (Honolulu: U of Hawai'i P, 1989) 16–21.
- ²⁶ Dirk J. Struik, *Yankee Science in the Making* (New York: Collier Books, 1962) 214–17, 222, 233, 242.
- ²⁷ Margaret W. Rossiter, *Women Scientists in America* (Baltimore: Johns Hopkins UP, 1982) 7–8.
- ²⁸ HMCS, *Missionary Album* 183.
- ²⁹ HMCS, *Missionary Album* 137.
- ³⁰ HMCS, *Missionary Album* 75.
- ³¹ Sereno E. Bishop, "Reminiscences of Mother Parker," *F* 1907: 11–13.
- ³² Elisha Loomis, "Copy of the Journal owned by W. D. Westervelt," U of Hawai'i Library, 1937: 8 Feb. 1825, 28; L. B. Coan, *Titus Coan, a Memorial* (Chicago: Fleming H. Revell, 1884) 75.
- ³³ Sarah Joiner Lyman, *Sarah Joiner Lyman of Hawaii: Her Own Story*, compiled by Margaret Greer Martin (Hilo: Lyman House Memorial Museum, 1970) 180.
- ³⁴ W. L. Scoville, "Our Honorary President A. B. Lyons, A.S., M.D., F.R.C.S.," *Journal of the American Pharmaceutical Association*, Dec. (1913): 1.
- ³⁵ Mary Charlotte Alexander, *Dr. Baldwin of Lahaina* (Berkeley: U of California P, 1953) 137.
- ³⁶ David Dwight Baldwin, "List of Hawaiian Mosses and Hepaticae," *HHA* (1876): 40–42.
- ³⁷ Samuel C. Damon, "Professor Edward Hitchcock," *F* May (1864): 36.
- ³⁸ Asa Gray, acknowledging receipt of "a very fine package of dried plants collected by my friend the Rev. John Diell . . . set about them immediately, and it

- has taken me nearly all my time this month to study them. . . . I shall send my notes about them to Professor Hooker of Glasgow, Scotland, that he may . . . publish them in the "Journal of Botany, . . ." A. H. Dupree, *Asa Gray 1810-1888* (Cambridge: Belknap P, 1959) 54.
- ³⁹ Charles S. Stewart, *Journal of a Residence in the Sandwich Islands* (London: H. Fisher & Son, 1842) 404.
- ⁴⁰ Augustus A. Gould, *Mollusca and Shells. U.S. Exploring Expedition*, Vol. XII (Philadelphia, 1852); Dimond ms. letters, AH; C. Matheson, "G. B. Sowerby the First and his Correspondents. Part II." *Journal of the Society for the Bibliography of Natural History* 4 (1961): 253-66.
- ⁴¹ Jesse W. Mighels, "Descriptions of Shells from Sandwich Islands and Other Localities," *Proceedings Boston Society Natural History* 4 (1845-1848): 18-26; Richard I. Johnson, "Jesse Wedgewood Mighels with a Bibliography and a Catalogue of his Species," *Occasional Papers on Mollusks* (1949): 1; E. Alison Kay, "Jesse Wedgewood Mighels and his Hawaiian cowries," *Hawaiian Shell News* 11.8 (1963): 4; E. Alison Kay, "A Tribute to Hawaii's Missionaries: Shell Collectors and Conchologists," *Hawaiian Shell News* 18.4 (1970): 4.
- ⁴² Chamberlain, "Algae of the Hawaiian Islands" 32-39.
- ⁴³ Goodrich, "Letter," in Silliman, "Notice," 5.
- ⁴⁴ Benjamin Silliman, "Notices from a Letter Addressed to the Editor," *American Journal of Science* Ser. 1, 20 (1831): 229.
- ⁴⁵ Alexander, *Dr. Baldwin* 72.
- ⁴⁶ Rufus Anderson, Ms. letters, Lyman House Memorial Museum.
- ⁴⁷ Ethel M. Damon, *Letters from the Life of Abner and Lucy Wilcox* (Honolulu: Privately Printed, 1950) 285.
- ⁴⁸ Alexander, *Dr. Baldwin* 40; Ms. list, Baldwin House, Lahaina; John Thomas Gulick, "Memorandum of Books Read," Ms., Bancroft Library, U of California Berkeley.
- ⁴⁹ Stewart, *Journal* 326-27.
- ⁵⁰ Oliver P. Emerson, *Pioneer Days in Hawaii* (New York: Doubleday, Doran & Co., 1928) 70.
- ⁵¹ S. J. Lyman, *Story* 63.
- ⁵² Jeannette E. Graustein, *Thomas Nuttall, Naturalist: Explorations in America, 1808-1841* (Cambridge: Harvard UP, 1967) 311.
- ⁵³ Titus Coan, *Life in Hawaii* (New York: Anson D. F. Randolph & Co., 1882) 68.
- ⁵⁴ Judd, *Dr. Judd* 101; Stanley D. Porteus, *A Century of Social Thinking in Hawaii* (Palo Alto: Pacific Books, 1962) 353. Judd nearly lost his life on the expedition. While collecting gases in Kilauea crater, he was pinned under an overhanging ledge by a sudden explosion just as a river of lava was rolling toward him. He was rescued by his Hawaiian guide, Kalama, with only a burned shirt and wrist.
- ⁵⁵ Alexander, *Dr. Baldwin* 150.
- ⁵⁶ *Hawaiian Spectator*, 1 (1838), 2 (1839); Judd, *Dr. Judd* 82-83.
- ⁵⁷ *Royal Hawaiian Agricultural Society Transactions* 1, 2 (1850-1854).

- 58 Harry L. Arnold, Jr., "Hawaii Medical Association, 1856-1956," *Hawaii Medical Journal* 15 (1956): 313-24.
- 59 Oswald A. Bushnell, "Much Ado about Little Things: Microscopes and Microscopists," *HJH* 3 (1969): 102-105.
- 60 The Social Science Association of Hawaii, *A Centenary Celebration, 1882-1982* (Honolulu: U of Hawai'i P, 1982) 235.
- 61 George C. Read, *A Voyage around the World: A Narrative of a Voyage in the East India Squadron under Commodore G. C. Read in 1838, 1839, and 1840*. By an Officer of the U.S. Navy (Boston: B. B. Mussey, 1848) 2: 226.
- 62 Alexander, *Dr. Baldwin* 72.
- 63 Sereno E. Bishop, "Old Memories of Kailua," *F* 1916: 38; Lucy Goodale Thurston, *The Missionary's Daughter: Memoir of Lucy Goodale Thurston of the Sandwich Islands* (New York: American Tract Society, 1842) 47.
- 64 H. M. Lyman, *Hawaiian Yesterdays* 24.
- 65 Scoville, "Our Honorary President" 1.
- 66 Mary C. Alexander and Charlotte P. Dodge, *Punahou's First Hundred Years* (Berkeley: U of California P, 1941) 251, 272, 292, 360; Hawaiian was taught after 1863. *The Friend*, 1863, also reported on the Punahou curriculum, citing teachers and the subjects they taught and congratulating students on their attainments.
- 67 Alexander and Dodge, *Punahou* 117.
- 68 H. M. Lyman, *Hawaiian Yesterdays* 191-92; Alexander and Dodge, *Punahou* 167.
- 69 Thurston, *Missionary's Daughter* 52.
- 70 Mary C. Alexander, *William Patterson Alexander in Kentucky, the Marquesas, Hawaii* (Honolulu: Privately Printed, 1934) 325; Alexander, *Dr. Baldwin* 227; Damon, *Letters* 364.
- 71 J. T. Gulick, *Journal*, HMCs Library; A. Gulick, *John Thomas Gulick* 511-14.
- 72 David D. Baldwin, "The Land Shells of the Hawaiian Islands," *HAA* (1886): 55-63; *Catalogue of Land and Freshwater Shells of the Hawaiian Islands* (Honolulu: Press Publishing Co., 1893).
- 73 Robert C. Haskell, "On a Visit to the Recent Eruption of Mauna Loa, Hawaii," *American Journal of Science* 2nd Ser., 28 (1859): 66-71; Alexander and Dodge, *Punahou* 222. Haskell may have been the first to use the terms 'a'ā and pāhoehoe. Coan, "The Volcanic Phenomena of the Island of Hawaii," *F* 1 Feb. (1866): 14, uses the term pāhoehoe, but not apparently earlier. The American volcanologist Thomas G. Bonney, *Volcanoes, Their Structure and Significance* (New York: G. P. Putnam's Sons, 1899) 79, comments they are "as needless as they are barbarous, and add nothing to the plain words, slaggy and clinkery. It is bad enough when geological literature is flooded by bastard Greek terms, but it is time to protest vigorously when recourse is had to the language of an insignificant and uncivilized race in a small archipelago in the North Pacific." William T. Brigham, "The Volcanoes of Kilauea and Mauna Loa on the Island

- of Hawaii," *B. P. Bishop Museum Memoirs* 2.4 (1909): 2, 4, says "the name [*pāhoe-hoe*] has so completely supplied a want in our vocabulary that, in spite of the oburgations of an English geologist, it has been adopted by all geologists treating of the Hawaiian lavas. Another native word, *a-a*, supplies another want. . . ."
- 74 W. D. Alexander Obituary, *F* 1913: 6; Alexander, *Dr. Baldwin* 279.
- 75 Scoville, "Our Honorary President" 1; A. Gulick, *John Thomas Gulick* 278.
- 76 Scoville, "Our Honorary President" 1.
- 77 Obituary, *F* Oct. (1914): 236.
- 78 Obituary, *F* 1915.
- 79 Sereno E. Bishop, "Origin of the Red Glows," Third Warner Prize Essay (Honolulu: Hawaiian Gazette Publishing Co., 1886) 1-8.
- 80 Adelbert von Chamisso, *Reise um die Welt mit der Romanzoffischen Entdeckungs Expedition in den Jahren 1815-1818* (English translation by M. and H. Hornmann, Sinclair Library, University of Hawai'i) 19.
- 81 Bailey, "Hawaiian Ferns" iii.
- 82 Wright and Takahashi, *Observations* XII-XIII.
- 83 Wyss, Koyanagi, and Cox, "Lyman" 2.
- 84 C. J. Lyons, Ms., HMCS Library.
- 85 Ms., HMCS Library.
- 86 Wright and Takahashi, *Observations* XIII.
- 87 Loomis, "Journal" 9.
- 88 Sereno E. Bishop, "Old Memories," *F* April: 74
- 89 Goodrich, "Letter," 4.
- 90 Loomis, "Journal," 28; L. F. Judd, *Honolulu: Sketches of Life in the Hawaiian Islands* (New York: Anson D. F. Randolph & Co., 1880) 29.
- 91 Edward Bailey, "Historical Notes," *Annual Report HHS* (1895): 14.
- 92 Loomis, "Journal," 5-6; Elisha Loomis, "Death of Captain Cook," *F* July (1936): 125.
- 93 S. E. Bishop, "Old Memories" May 87.
- 94 Wright and Takahashi, *Observations* XIII.
- 95 J. D. Dana, "Note on the eruption of Mauna Loa," *American Journal of Science* 2nd Ser., 14 (1852): 254-57.
- 96 J. T. Gulick, "Portions of a Lecture by J.T.G.," in A. Gulick, *John Thomas Gulick* 114-19.
- 97 E. Alison Kay, Read at Social Science Association, March 1992.
- 98 Hampton L. Carson, "The Process Where by Species Originate," *Bioscience* 37 (1987): 100.
- 99 Sereno E. Bishop, "Old Memories of Kailua," *F* (1901): 38; see also Sereno E. Bishop, *Reminiscences of Old Hawaii*, The Advertiser Historical ser. No. 1, 1916.
- 100 Meredith Gairdner, "Physico-diagnostic sketch of the island of Oahu, one of the Sandwich Group," *Edinburgh Journal* (1835): 1-18; reprinted in *Hawaiian Spectator* 1837.

- ¹⁰¹ Gerrit P. Judd, "Physico-diagnostic sketch. . .," *Hawaiian Spectator* 1837. Dr. Baldwin was equally dismissive of the Tahiti-based London missionary John Williams's descriptions of slow-growing corals and records of the heights of fossil coral islands south of Hawai'i. Baldwin calculated from Williams's descriptions that "these islands must then be at least 18,000 years old, . . ." and "the commencement of their formation long before the creation of the world." "Narrative of Missionary Enterprises in the South Sea Islands." Dwight Baldwin, "Review of Williams *Narrative of Missionary Enterprises in the South Sea Is.*," *Hawaiian Spectator* II (1839): 246–55.
- ¹⁰² E. O. Hall, "Notes of a Tour Around Oahu," *Hawaiian Spectator* Jan. (1839): 103–104; L. B. Coan, *Memorial* 138.
- ¹⁰³ Titus Coan, *Life* 313.
- ¹⁰⁴ A. B. Lyons, "Fossils of Hawaii Nei," *HAA* (1891): 100.
- ¹⁰⁵ S. E. Bishop, "Old Memories of Kailua," *F* (1901) April: 74.
- ¹⁰⁶ A. Gulick, *John Thomas Gulick* 113.